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## **AMENDMENTS TO THE CLAIMS:**

This listing of the claims will replace all prior versions, and listings, of the claims in this application.

## **Listing of Claims:**

Claims 1-15 (Cancelled)

16. (Currently Amended) <u>A receiver for receiving data and pilot symbols simultaneously over multiple channels comprising:</u>

at least one antenna;

a demodulator coupled to an output of the antenna for demodulating received symbols in accordance with a multi-carrier transmission technique,

a channel estimator coupled to the demodulator for estimating a channel of a multicarrier system using received pilot symbols;

a storage medium for storing a multi-level signal constellation defining C points, of which at least one point defines a first level and a plurality of points define a second level, and a minimum inter-level distance between points is based on a maximized minimum difference between conditional probability distributions; and

a mapper coupled to the demodulator and to the storage medium for converting the demodulated symbols to a plurality of data signals that each alone or in combination correspond to a constellation point wherein the demodulator determines a maximum likelihood conditional probability distribution of the received symbols and The receiver of elaim 15 wherein the conditional probability distribution is

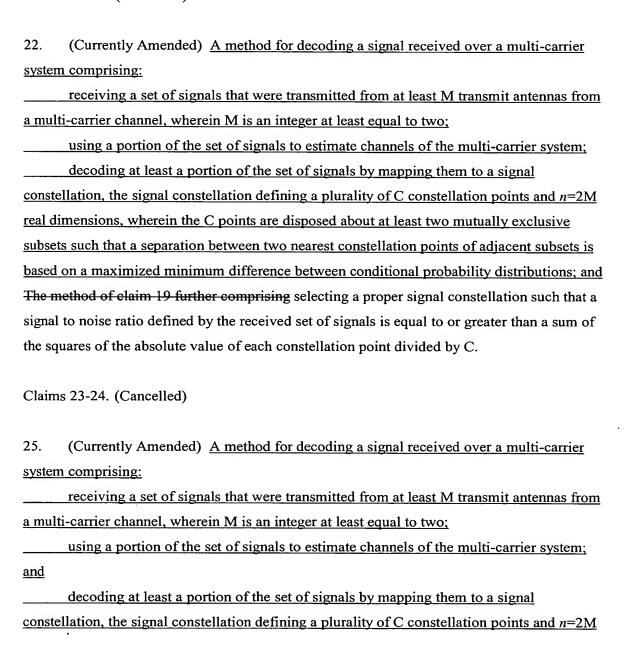
$$p(X_{i}|S_{i},\hat{H}_{i}) = \mathbb{E}_{\widetilde{H}_{i}} \left\{ p(X_{i}|S_{i},\hat{H}_{i},\widetilde{H}_{i}) \right\} = \frac{1}{\pi (\sigma^{2} + \sigma_{E}^{2}||S_{i}||^{2})} \exp \left\{ -\frac{\left\|X_{i} - S_{i}\hat{H}_{i}\right\|^{2}}{\sigma^{2} + \sigma_{E}^{2}||S_{i}||^{2}} \right\}$$

such that the detector maximizes over at least two possible values for  $S_i$  to find a transmitted symbol wherein  $S_i$  comprises a transmitted signal vector,  $\hat{H}_i$  comprises a channel estimate matrix,  $X_i$  comprises a received signal vector, and  $\tilde{H}_i$  comprises an estimation error matrix at

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an i<sup>th</sup> frequency bin,  $E_{\tilde{H}_i}$  is an error estimation matrix, and  $\sigma_E$  is the estimation variance at each frequency bin.

Claims 17-21. (Cancelled)



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real dimensions, wherein the C points are disposed about at least two mutually exclusive subsets such that a separation between two nearest constellation points of adjacent subsets is based on a maximized minimum difference between conditional probability distributions wherein mapping at least a portion of the set of signals to the signal constellation comprises determining a conditional probability distribution of each symbol within the at least a portion of the set of signals and The method of claim 24 wherein the conditional probability distribution is

$$p(X_{i}|S_{i}, \hat{H}_{i}) = \mathbb{E}_{\tilde{H}_{i}} \left\{ p(X_{i}|S_{i}, \hat{H}_{i}, \tilde{H}_{i}) \right\} = \frac{1}{\pi \left(\sigma^{2} + \sigma_{E}^{2} ||S_{i}||^{2}\right)} \exp \left\{ -\frac{\left||X_{i} - S_{i} \hat{H}_{i}||^{2}}{\sigma^{2} + \sigma_{E}^{2} ||S_{i}||^{2}} \right\}$$

that is maximized over at least two possible values for  $S_i$  for each symbol and wherein. $S_i$  comprises a transmitted signal vector,  $\hat{H}_i$  comprises a channel estimate matrix,  $X_i$  comprises a received signal vector, and  $\widetilde{H}_i$  comprises an estimation error matrix at an  $i^{th}$  frequency bin,  $E_{\widetilde{H}_i}$  is an error estimation matrix, and  $\underline{\sigma}_E$  is the estimation variance at each frequency bin.